ANATEK

INSTRUCTION MANUAL

LABORATORY POWER SUPPLIES

BIN
64

ANATEK ELECTRONICS LTD.

INSTRUCTION MANUAL

LABORATORY POWER SUPPLIES

MODEL: 50-1S
50-1D
25-2S
25-2D

DRWG A6282
P/N 4200-6001

CONTENTS

Specifications 1

Installation and Operation 3

Theory of Operation 6

Parts List 8

Schematic Diagram 9

NOTE: This Manual is intended to cover both 25 Volt and 50 Volt Power Supplies, single and duals. The basic text will be written for the 25 Volt model. Any differences in specs and performance for the 50 volt model will be given in square brackets[].

SPECIFICATIONS

Input ..... 117 Vac ± 10%, 57-63 Hz, 0.8A

Output ..... 0 - 25 Vdc
0 - 2 Adc
cont. adjustable

[0 - 50 Vdc]
[0 - 1 Adc]
cont. adjustable

Static Voltage Regulation

Line ..... 0.03% + 1 mV max for 10% change in line voltage (load constant)

Load ..... 0.02% + 1 mV max for no load to full load change (line constant)

Stability ..... 0.02% over 9 hours after 1/2 hr warm-up period

Temp. Coefficient . 0.015%/°C

Static Current Regulation

Line ..... 0.2% + 1 mA for 10% change in line voltage (load constant)

Load ..... 1.0% + 1 mA for load change 10% to full (line constant)

Ripple and Noise .. 500 µV rms maximum
200 µV rms typical

Transient Response: Output returns to within 10 mV of its previous value in 20 µsec or less (step change from half to full load)

Operating Temp. ... 0 - 35°C
derate 24 mA/°C [12 mA/°C] above 35°C up to 60°C maximum temperature

All units are designed for convection cooling:

DO NOT BLOCK VENTILATION HOLES! (top & bottom)

Adjustments

Voltage ..... 10 - turn control, resolution 2.5 mV [5 mV]

Current ..... single turn control

Accuracy of meters .+3% of full scale deflection

Output connectors . 5 - way binding posts

Dimensions (H x W x D): Model 25-2S, 50-1S
5.75 x 4 x 10.25 inches
14.6 x 10.2 x 26 centimeters

Model 25-2D, 50-1D
5.75 x 8 x 10.25 inches
14.6 x 20.3 x 26 centimeters

Weight ..... Model 25-2S (50-1S) 7 lbs (3.2 kg)
Model 25-2D (50-1D) 13 lbs (5.9 kg)

Anatek Electronics reserves the right to make changes or improvements in its products without incurring any obligation with respect to products previously manufactured.

INSTALLATION AND OPERATION

Unpack power supply and check for damage that might have occurred during shipment. Any claims for shipping damage should be made against the shipping company, NOT against Anatek Electronics Ltd.

BEFORE CONNECTING the unit to an AC outlet, make sure that the power switch is in "OFF" position and the Voltage & Current Controls are in the full counter clockwise position. The AC line voltage should be 117 V nominal (105-128 V).

Connect either the (+) or (-) terminal to the ground (GND) terminal depending upon the desired output voltage polarity. Use grounding barrier or short wire for this connection. If the output voltage is to be biased relative to ground, it is recommended that a 0.1 uF capacitor of sufficient voltage rating (200-1000V) be used in place of the shorting connection. The power supply output may be biased up to max. 500Vdc (positive or negative).

Plug line cord into GROUNDED AC outlet.
Switch power switch to "ON" position.
The pilot light located above the power switch will light, the meter readings will remain zero.

To use the power supply in the CONSTANT VOLTAGE MODE:
Turn the current control to the extreme clockwise position and set the voltage control to the desired voltage. The maximum current level (at any voltage setting) is approx. 2.4 A (1.2 A). Note that voltage regulation specifications apply for a maximum current level of 2 A (1 A).

Operating the supply in the CONSTANT CURRENT MODE:
Turn voltage control to the extreme clockwise position and the current control fully counter

clockwise. Connect shorting lead across output terminals. Set desired maximum value of current control slowly clockwise. Observe Ammeter; disregard reading on Voltmeter. Disconnect shorting lead across output terminals.
The power supply will now automatically switch into current mode (current regulation) as soon as the set current level is reached and will not exceed this level (at any voltage setting) within the specification limits. (See Fig. 1) With the output voltage set at 20 Vdc and the current level slightly over 0.5 A, the power supply will be in Constant Voltage mode when a load of 40 Ohms (or larger) is connected. However, when a load of 20 Ohms is connected (the settings for voltage and current remaining the same), the power supply will be in the Constant Current mode with the voltage automatically decreased to a level of 10 Volts.

(Ohms Law: 20 Ohms X 0.5 Amps = 10 Volts)

Operation of DUAL SUPPLY.

This supply consists of 2 fully independent power supplies which have only the power switch and the pilot light in common. For independent operation of each supply the same procedure as outlined previously applies.

For PARALLEL OPERATION: Set both voltage controls to the same voltage before connecting the two (+) terminals and the two (-) terminals in parallel. Connect the load to either of each of the output terminals and adjust the voltage controls until both Ammeters show the same current. This indicates that both supplies share the load current equally. A total current of approx. 4.8 A (2.4 A) is available.

The maximum voltage remains 25 Vdc (50 Vdc).

For SERIES OPERATION: Connect the (-) terminal of the left section of the supply to the (+) terminal of the right section. A total voltage of max. 50 Vdc (100 Vdc) is now available (CAUTION!) between the (+) terminal of the left section and the (-) terminal of the right section. (Add readings of both Volt meters). Connect the positive or the negative terminal to either of the (GND) terminals (depending on the desired output polarity).

If a "SPLIT" SUPPLY is desired connect either of the (GND) terminals to the (-) terminal of the left section or the (+) terminal of the right section (the connection between those two terminals remains!).
The left section ((+) terminal) then provides a positive voltage relative to ground and the right section ((-) terminal) a negative voltage. The current limits (current control) can be set independently. The max. current available in series or "split" operation remains approx. 2.4 A (1.2 A).

THEORY OF OPERATION:

Single phase AC power is applied to the primary winding of tranformer T1. The main secondary winding (terminals A.B,C) provides 32 VAC 56 VAC which is rectified by the bridge CR2-CR5 and fed to filter capacitors C4 and C5, charging them to 23VDC [40VDC] and 46VDC [78VDC] respectively. This rectifier-filter combination provides the main DC raw voltage source for the supply.

The auxilliary secondary winding (terminal D,E) provides 19VAC which is rectified by CR1 and filtered by C3. The resulting 27VDC provides the auxilliary DC voltage for the control circuitry. Capacitors C1 and C2 serve to suppress noise and/or transients.

The auxilliary voltage is conditioned by op-amp U1a, resistors R1, R2, R3 and R7, reference zener CR7, and capacitors C6 and C7 to form a highly stable voltage reference. This reference voltage is then applied across potentiometer R21 (front panel voltage adjustment control) to yield an adjustable set point for the voltage control circuitry.

Op-amp U1b, resistors R4, R5, R9, R10, diodes CR8, CR9 and CR11 and capacitor C9 serve to control the output voltage to its set value. While the voltage control is achieved by these components, it is actually op-amp U1d which supplies the drive current to the pass elements. As long as the power supply is operating in voltage control (and not in current limit), diode CR11 will be forward biased through R13 allowing op-amp U1b to control the anode voltage of CR10 and also, therefore, the drive to Q1. CR12, CR8, and CR9 limit the input voltages to U1b, ensuring that it stays in common mode range. CR10 compensates for the saturation voltage of U1B to allow adjustment to zero output.

The pass element stage has two modes of operation. As long as the output voltage requirements are less than the valley voltage of C4 minus the CR6 diode drop, the

Q2 satuartion voltage and the shunt voltage drop in R15, then Q2 acts to pass the output current, using Q1 for base drive. If the output voltage requirements are higher, then the collector of Q2 turns off, and the drive current all flows from collector to emitter of Q1 and out through the base-emitter junction of Q2. Rectifier CR6 blocks current flow through the base-collector junction in Q2 during the latter mode of operation.

The current control circuit is formed by op-amp U1d, resistors R6, R8, R12, R14, R16, shunts R15 and front panel mounted potentiometer R20. The reference voltage is applied across R6 and R20. The current control op-amp senses the current limit setpoint from the wiper of R20. When the current through shunt R15 yields sufficient rise in shunt voltage, op-amp U1D assumes control of the pass elements by reverse biasing CR11, this eliminating U1b from the control loop.

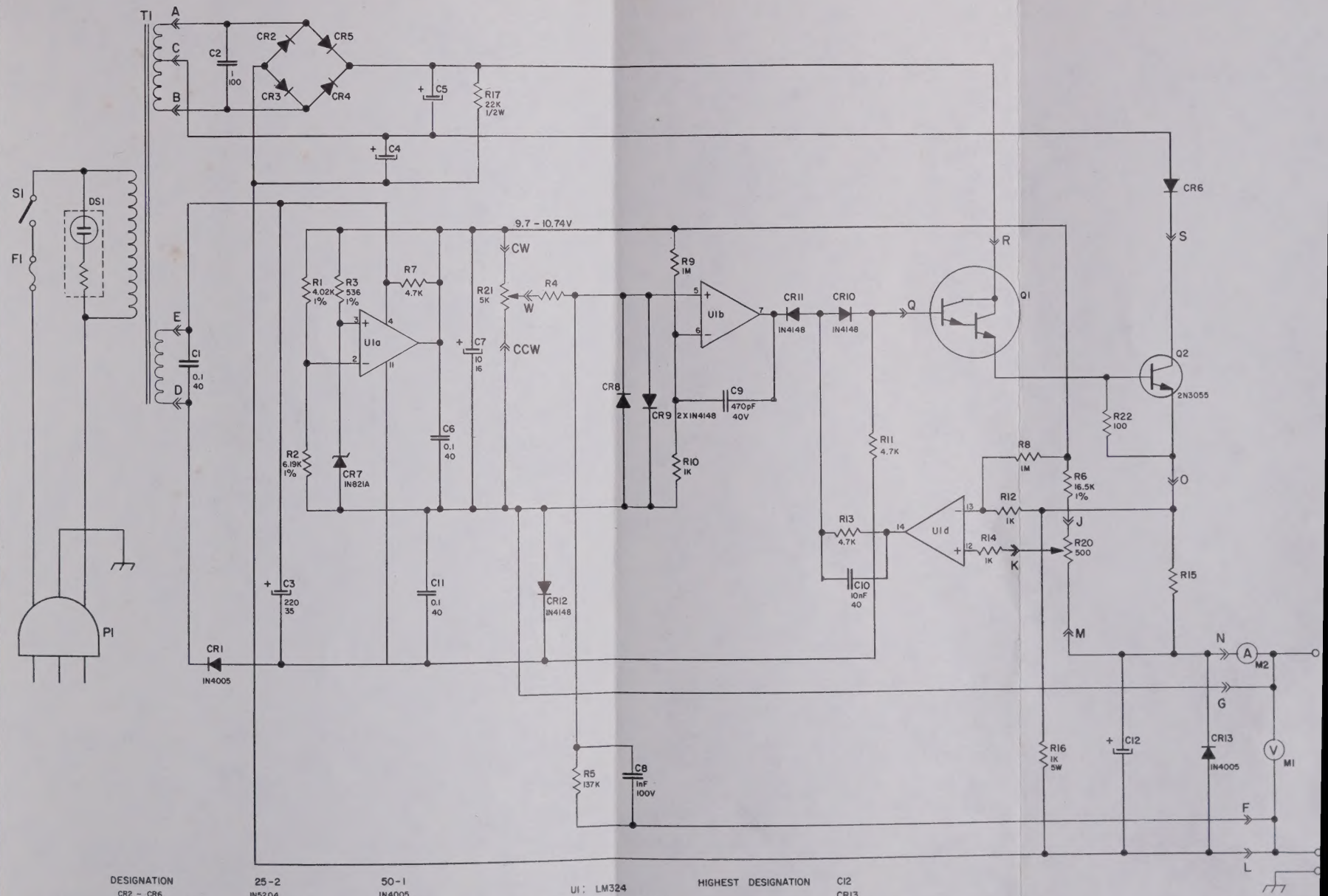
Capacitor C8 aids loop stability in voltage control mode, while C1D does the same in current control mode. Capacitors C6, C7 and C11 help to further innunize the control circuit against AC line transients. Capacitor C12 improves transient load response at the output. CR13 protects the power supply from reverse bias destruction in the event of improper connection during parallel operation.

PARTS LIST

PARTS IN BRACKETS [ ] ARE FOR 50V MODELS

DESIGNATION	DESCRIPTION	ANATEK P/N
C1, C6, C11	0.1uF/40V	1501-9050
C2	1uF/100V	1512-4000
C3	220uF/35V	1502-0902
C4, C5	4700uF/25V	1502-3755
[C4, C5]	2400uF/25V	1502-2750
C7	10uF/15V	1508-3050
C8	1uF/100V	1501-0400
C9	470pF/40V	1501-4050
C10	10uF/40V	1501-7000
C12	220uF/35V	1502-0902
[C12]	100uF/63V	1502-0701
CR1,CR13	1N4005	4802-2001
CR2-CR6	1N5402	4802-3000
[CR2-CR6]	1N4005	4802-2001
CR7	1N821A	4808-1000
CR8-CR11	1N4148	4805-7000
DS1	Pilot Light	3902-2000
F1	1.5A SB (single Supplies)	5101-7250
	2.5A SB (dual supplies)	5101-7300
U1	MLM324	3140-8200
M1	25V F.S.	2901-8120
[M1]	50V F.S.	2901-8130
M2	2A F.S.	2901-8110
[M2]	1A F.S.	2901-8100
Q1	2N6576	4811-2180
[Q1]	2N6577	4811-2181
Q2	2N3055	4811-1010
R1	4.02K 1%	4705-2600
R2	6.19K 1%	4705-2915
R3	536 OHM 1%	4705-2290

DESIGNATION	DESCRIPTION	ANATEK P/N
R4	51.1K 1%	4705-3950
[R4]	26.1K 1%	4705-3825
R5	137K 1%	4705-8800
R6	16.2K 1%	4705-3650
R7, R11, R13	4.7K 5%	4703-2650
R8, R9	1M 5%	4703-5050
R10,R12,R14	1K 5%	4703-1900
R15	0.12 OHM 5% 2W	4706-0060
[R15]	0.24 OHM 5% 2W	4706-0080
R16	1K 5W	4706-2600
R17	22K 1/2W	4703-7100
R20	500 OHM Pot.	4701-2005
R21	5K 10T Pot.	4702-1300
S1	SPST	5106-4000
T1	Power X/F	5602-0500
[T1]	Power X/F	5602-0750
Cabinet, single supply		1402-3000
Cabinet, Dual supply		1402-4000
Front Panel, single supply		1406-1100
Front Panel, dual supply		1406-1000
Handle		2404-6000
Feet, rubber		2819-5000
Knob, control		2405-3000
Binding post, black		2101-0300
Binding post, green		2101-6000
Binding post, red		2101-9000
Line cord		6005-3000
Strain releif		2806-4100
Fuse holder		2102-1500
PCB Assembly 25V		8225-1001
PCB Assembly 50V		8205-1001



DESIGNATION	25-2	50-1
CR2 - CR6	IN5204	IN4005
C4, C5	4700μF/25V	2200μF/50V
C12	220μF/35V	100μF/63V
Q1	2N6576	2N6577
R4	51.1K 1%	26.1K 1%
R15	0.12Ω 5% 5W	0.24Ω 5% 5W
T1	5602-0500	5602-0750
M1	0-25VDC	0-50VDC
M2	0-2A	0-1A

U1: LM324

CIRCUIT FUNCTIONS:

U1a - Voltage reference

U1b - Voltage control

U1d - Current Control

HIGHEST DESIGNATION C12, CR13, R22

SYM	DESCRIPTION	ITEM NO.	QTY.	MATERIAL
A	CORRECTION			

TOLERANCES UNLESS OTHERWISE SPECIFIED: * - ECALEY

DATE 2 Nov. 1979

DRAWN

CHECKED K. ROBART

APPROVED K. ROBART

DESIGN L. HUFFSTUTLER

ANATEK ELECTRONICS LTD.

VANCOUVER B.C. CANADA

TITLE: LAB SUPPLY CONTROL SCHEMATIC

THESE DESIGNS AND SPECIFICATIONS ARE THE PROPERTY OF ANATEK ELECTRONICS LTD. AND SHALL NOT BE COPIED OR USED FOR MANUFACTURING WITHOUT ITS WRITTEN CONSENT.